
The National Science and Technology Policy Forum

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Foreword

The National Science and Technology Policy Forum took place in Winnipeg in June 1986. It brought together some 200 eminent Canadians from industry, labour, and universities to discuss the science and technology issues most crucial for Canada's future development.

At the request of the Honourable Frank Oberle, minister of state for science and technology, the Science Council undertook to design and manage the forum and to produce a report of the proceedings.

The Council acknowledges the close cooperation of the minister's staff and the valuable part played by officials of the Ministry of State for Science and Technology in handling arrangements for the conference and in preparing the background paper sent to all participants. The Council also acknowledges the excellent support of the Canadian Intergovernmental Conference Secretariat.

This document describes the purpose and organization of the forum and presents the proceedings. The meeting was not intended to pass any resolutions; however, it did identify a number of points of agreement and disagreement. These are summarized in chapters 3 and 4.

Stuart L. Smith
Chairman
Science Council of Canada

1. Purpose and Organization of the Forum

The National Science and Technology Policy Forum was part of a policy development process that began with a meeting of federal, provincial, and territorial science and technology ministers held in Calgary in February 1985. At that meeting these ministers made a commitment to formulate a national science and technology policy with three principal objectives:

- to strengthen private-sector innovation;
- to encourage the transfer and application of technology;
- to develop the long-term competitiveness of Canadian industry by supporting basic scientific research.

To build on this initiative, the minister of state for science and technology wrote to selected industry, academic, and labour leaders — many of them nominated by the provinces — inviting them to take part in a national forum and to submit briefs in advance outlining how their sector could contribute to a national science and technology plan. The minister then asked the Science Council to design and manage the forum and to produce a report of the proceedings.

The aim of the forum was neither to set policy nor to seek creative new responses, but rather to indicate to governments the points on which there was consensus, to flag areas in which agreement could not yet be reached, and to clarify the nature of any disagreement.

To elicit responses along these lines, the forum featured a day of workshops on three themes:

- developing and acquiring new knowledge;
- putting knowledge to work and creating opportunities;
- involving all Canadians and adapting to change.

In total, 18 workshops were scheduled so that all delegates could attend one workshop on each theme. Each workshop consisted of a moderator, a resource person, a rapporteur, and about 30 participants, plus a number of observers from the federal and provincial governments.

To help structure discussion in the workshops, the Science Council prepared "propositions," based largely on material drawn from participants' submissions. These propositions were worded so as to encourage debate and to permit comparable conclusions to be drawn from different workshops.

The day of workshop discussions was followed by a half-day plenary session. At this session the forum chairman summarized the results of the workshops, then called on industry, academic, and labour representatives to give their reactions. Finally, delegates were invited to speak from the floor on points of concern.

2. Opening of Proceedings

As chairman of the forum, Dr Stuart Smith opened the proceedings by welcoming participants and outlining the roles of the various parties responsible for planning the meeting.

The forum represented an opportunity, he said, to underline the importance of science and technology, the importance of research, and the importance of knowledge generally. He added that many valuable briefs had been received: common to all was a recognition that science and technology are essential to Canada's future as an advanced industrial nation.

Dr Smith then introduced the Honourable Victor Schroeder, minister of industry, trade, and technology for the host province, Manitoba. Mr Schroeder welcomed participants to Manitoba, pointing out that the province is aware of the importance of science and technology to regional development, the overall growth of the economy, and the generation of increased employment. He then outlined some of the initiatives being taken by the province to develop and transfer technology and to promote the organizational and personal adjustments necessary to cope with technological change.

Following Mr Schroeder's welcome, the chairman called on the federal minister of state for science and technology, the Honourable Frank Oberle, to address the meeting.

Mr Oberle began by thanking participants for responding to his invitation to contribute to the development of a science and technology policy for Canada. In his comments on the purpose of the forum, he said that what was needed was not a think-tank nor another consultation. Rather the objective was to develop a new national purpose, using science and technology to maintain a high standard of living for future generations of Canadians and to enable Canada to play its part in resolving urgent world problems.

Mr Oberle described the forum as an important part of a process that included several federal-provincial meetings, a series of bilateral discussions between the federal government and the provinces, and numerous round-table discussions throughout Canada.

He said that the prime minister had given him a mandate to act, and that he shared with partic-

ipants a sense of urgency to forge consultation into cohesive effort. Stressing the importance of working together, he warned that it would be a mistake to think that complex problems can be solved simply by throwing money at them.

He then reported that an inventory of federal initiatives in science and technology prepared at his request showed expenditures of \$4.2 billion, \$2 billion of which were for research and development. He questioned whether it might not be better to place some of this money in Canadian industries and universities, and use it as leverage to generate greater involvement of the private sector.

As the next step in the policy development process, Mr Oberle said he would use the record of the forum to help prepare recommendations to cabinet on how Canada might redirect this spending to get the best use of taxpayers' money for science and technology. The process is expected to result in the announcement of a national science and technology policy.

In his concluding remarks, the minister reminded participants of the basic values that form the backdrop for public policy in Canada: personal freedom, fairness, compassion, tolerance, respect for our heritage, and responsibility for the environment.

The chairman then outlined the order of business for the rest of the meeting, explaining that the objective was to produce position statements on specific ideas that politicians could take into account in formulating a national science and technology policy.

3. Summary of Agreement and Disagreement

After the opening session, delegates parted to spend the rest of the day in workshop discussions. During the evening, the workshop moderators, resource persons, and rapporteurs prepared brief reports on the main points of agreement and disagreement to emerge from the set of workshops to which they had been assigned. These reports were then synthesized into a summary, which was presented to the plenary session by the forum chairman, Dr Smith.

The principal message to emerge from the forum, Dr Smith said, was that Canada's opportunity to remain a prosperous nation will depend directly on the extent to which Canadians are able to master and apply technology and to cooperate in doing this. Another view, of importance to many at the forum, was that Canada needs to maintain a caring society as it adopts and promotes science and technology, making sure to control their effect on society and the environment.

Dr Smith drew a parallel between Canada and Australia. Australians, he said, are having trouble deciding whether they are going through a period of incremental change or a time of radical discontinuity. In a way, Dr Smith said, the forum had asked the same question.

As far as economic development is concerned, the forum had concluded that there is a radical discontinuity and that the time has come to change the way priorities are set in this country. There was consensus that Canada is entering a totally new era of economic development, but it could well fall behind if it does not develop new attitudes and new solutions. Canadians need leadership to help them understand the change that lies ahead. To modernize existing industry and to diversify into new industry requires new ways of working together. But more than anything else, it requires that Canadians become proficient at importing, developing, adapting, and using new science and technology.

Participants had not reached consensus on the social impact of science and technology, Dr Smith said. They generally felt that technology has been a positive factor for society in the past, and many believe it will be so again. But even if more jobs are created (as many believe will happen) and even if society benefits (as most believe will happen),

there was general concern about whether individuals will be able to adapt successfully to change. It was felt that any just and reasonable society has to recognize the need for the equitable distribution of income and of opportunity. There was disagreement, however, as to whether this need is now radically different because of technological change.

There was some uncertainty as to whether Canada needs new ways of dealing with technological change and its impact on society or whether it can adapt to change by using existing mechanisms. However, Dr Smith noted consensus that the effects of change will have to be monitored carefully and that Canada needs to invest much more than it does now in studying ways to deal with environmental, social, and personal aspects of technological change. He also noted general agreement that, wherever possible, all sectors will have to work together to implement the changes; however, it was unclear how far this should be brought about by legislation.

The call for action, particularly action by the federal government, was evident throughout the meeting; but it was stressed that such action must respect the federal structure of Canada. Dr Smith pointed out that on every proposition that dealt with regional distribution or provincial initiatives, the meeting had decided that the federal government must act in concert with and in support of the provinces. Participants had recognized that centralization of effort to achieve excellence and critical mass may play an important part in overall development, but felt that regional development could be better achieved through personal communication between experts who continue to work in various parts of the country.

The meeting had called for more research and more support for research, both basic and strategic, in Canada. The feeling was that even with the benefits of the matching system, intended by government to increase the amount of money available for research, Canada still gives too little support to producing new ideas and highly qualified personnel.

One idea that prevailed throughout the meeting, said Dr Smith, was that small businesses of an innovative kind will be an important engine of growth in Canada's future. Government should

therefore, in formulating a national policy for science and technology, consider ways to enhance the contribution of such industries.

There was also agreement that high priority should be accorded to education, since knowledge is expected to be the most important factor in guaranteeing the prosperity of the country. Governments were therefore implored to resolve their differences on the funding of higher education.

Finally, there was complete agreement that science and technology must enjoy a much higher profile in the governments of this country. In particular, participants had stressed that science and technology must be represented by one means or another at the highest levels in the federal cabinet.

In summary, Dr Smith said that the consensus of the meeting was that Canada faces an exciting period in its history, but it is a challenging period that could lead the country to decline. If the standard of living declined greatly, many Canadians would want to move to the United States. Little by little, they would drift to where the opportunities lie.

The conclusion was that if Canada does not master science and technology, then its future could be bleak indeed. On the other hand, there was great confidence that Canada has the human resources that are necessary to master the challenge of science and technology; that it has a civilized society that can come to grips with technological change and its impact on people; and that it has the ability to be a world leader in any knowledge-intensive industry to which Canadians put their minds and effort. What we have to learn is to work together, recognizing regional diversity and accepting the importance of the current changes that are rooted in science and technology.

4. Summary of Workshop Discussion

The following sections report on the workshop discussions in some detail. Given the emphasis on putting knowledge to work and linking science and technology to economic development, this theme is treated first.

This conference considered that the most urgent problem facing Canada today is how to increase industrial competitiveness and retain a high standard of living, given changes in the world economy. Most participants believed that the first task of science and technology policy today is to secure Canada's economic survival. At the same time, they felt that science and technology should also support social and cultural goals.

Putting Knowledge to Work and Creating Opportunities

Creating opportunities was seen as the direct responsibility of business and industry. The role of government is therefore to create a climate that will foster industry's capacity to innovate. There was agreement on the crucial importance of predictability and coherence in government policies. In order to plan and carry out productive long-term R&D programs, industry must be able to count on policies and programs remaining in force for a number of years. Government programs intended to assist industry must be harmonized so that an overall purpose is evident and there is consistency between the programs of the various departments.

Small business was generally regarded as the major engine of future economic growth and the most promising creator of new opportunities. In view of the cardinal importance of this role, wider acceptance of the spirit of entrepreneurship in Canada was considered imperative. Furthermore, businesses must learn to work together in putting knowledge to work, while still remaining competitive.

Canadians were urged to expand their concept of culture to include science and technology as well as the arts and publishing. Only if the public understands the nature of the scientific enterprise and the centrality of science and technology to social and economic goals, can Canada hope to secure its future as an advanced nation.

As a first step, the federal government must attach more importance to science and technology within the policy-making process. Next, the government should strive to heighten public awareness of scientific and technical activities and achievements. It was suggested that a megaproject of national scope, similar to that of the American space program, could be useful in firing the public's imagination and focusing significant investments. However, the difficulty of finding an appropriate and charismatic project was recognized.

Supporting Provincial Initiatives

Delegates urged the federal government to support provincial initiatives wherever possible, preferably by means of formal agreements with the provincial governments. This is already beginning to happen, and the trend was strongly endorsed by the meeting. It was felt that provincial governments know what they are doing: they know what is happening in their own areas and they have their own aspirations. As long as these do not balkanize the country and reduce the federal government to being a tax collector on behalf of the provinces, the federal government should support provincial initiatives wherever possible.

Ongoing Sectoral Consultations

There was strong support for setting up a process of regular consultation within industry, and between government and industry. The suggestion was that governments should encourage the various industrial sectors to meet regularly, to identify their problems, and to explore scientific and technological solutions. There should also be regular meetings between government and industry so that government is kept informed of each sector's views.

Some participants said that such consultation should be entirely voluntary, with no formal structuring. Others felt that industrial associations should play a prominent role in the process. A minority expressed the view that companies would not be willing to engage in discussions since this might require them to share information on strategies with their competitors.

Government Procurement

An active program of government procurement was seen as one of the main ways in which government can promote innovative capability within industry and guarantee the success of Canadian technology firms. Canadian firms and foreign-owned firms that act as good corporate citizens (particularly in the sense that they have world product mandates or are working hard to improve Canada's export position) should have the same benefits and advantages that other countries provide their companies by means of defence and civilian procurement programs.

A few participants, including some from the labour movement, raised concerns about any reliance on military procurement, whereas others pointed out that the free-trade negotiations could cause some difficulty for government procurement programs.

Encouraging Venture Capital

Governments should undertake programs to increase the availability of pre-venture and venture capital, particularly for innovative small and medium-sized enterprises. Increasing the flow of such capital was regarded as essential for Canada's economic health. Participants stressed the need for seed capital from patient investors who are willing to invest in an enterprise for three to five years before expecting a return.

Cooperative Pre-Competitive Research

The government was urged to encourage companies to undertake cooperative pre-competitive research and development, by means of measures such as catalytic funding and tax incentives. Such research, conducted under the guidance of potential users, would be more likely to find its way to the marketplace than research done in separate institutions. Participants recognized that it would take industry some time to adapt to this kind of approach because traditional competition has accustomed companies to working in isolation.

Consulting Services for Industry

General support was expressed for the proposition that governments should expand programs that help industry to acquire, develop, and apply technology. Examples of these programs include the National Research Council's technical information service and similar services offered by provincial research organizations and the liaison offices of universities and community colleges.

It was suggested that universities and colleges should play a larger role in diffusing innovation and technology. Student exchange programs were cited as a useful diffusion mechanism. "Students are to technology as mosquitoes are to malaria," as one participant put it. However, small business criticized some "outreach" programs on the grounds that business often has to do too much of the reaching.

Rationalizing Technology Centres

Participants agreed that federally and provincially funded technology centres require rationalization. Industrially oriented research centres were recognized as filling a valuable niche, but concern was expressed about the number already in existence (some 300 centres receive federal funding according to a recent study by the Ministry of State for Science and Technology) and the fact that they are too isolated in their work. Such centres should be better acquainted not only with industrial needs but also with the needs of social and economic policy. They should also become more closely affiliated with educational facilities.

It was recommended that governments build new technology centres only in response to industry demand, demonstrated by financial participation. Exceptions could be made in the case of infant industries. Participants stressed the importance of flexibility to enable research centres to adapt to rapid change.

The missions of these centres should be continuously audited and reviewed by advisory boards with members drawn from industry and other sectors. Excellence should be rewarded, but performance review should take into account the fact that success may depend on the ease of the projects undertaken. Participants endorsed the notion

that duplication of effort between technology centres should be avoided, but recognized that some duplication is acceptable because of the contribution technology centres can make to regional development.

Adequacy of Grants and Tax Incentives

Opinions were sharply divided on the adequacy of the present system of grants and tax incentives in support of industrial R&D. Some participants called for radical revision, whereas others felt that only fine tuning was needed. However, there was general agreement that Revenue Canada's definition of R&D is too narrow. As Canada moves toward a knowledge-based society, the definition of research must be broadened to encompass more of the development process, including certain aspects of market research.

There was also general agreement on the importance of forward consistency in tax measures that are intended to encourage R&D. Some participants found tax incentives preferable to grants but commented that pegging incentives to tax does little to help firms just starting up.

Level of Industrial R&D

There was considerable controversy over whether industry should be expected to do more research and development, even at the expense of its own profits. There was a strong underlying feeling that Canadian businesses are too hesitant to undertake R&D. On the other hand, some felt that the R&D performance of Canadian industry may not be as poor as statistics suggest. International comparisons may be misleading because Canada has a different mixture of industries from that of other countries.

It was agreed that better statistical indicators are needed to achieve more accurate comparisons between the levels of R&D done by Canadian industries and their competitors. The crucial question, participants agreed, is whether Canadian companies are keeping up with their competitors.

Developing and Acquiring New Knowledge

Discussion of the development and acquisition of new knowledge was devoted almost exclusively to measures that could be taken within Canada. There was a reminder from participants, however, that since Canada's research endeavour is likely to remain a small portion of that carried out worldwide, Canadians must be skilled at acquiring technologies from abroad and adapting them to Canada's advantage. This implies monitoring science around the world, identifying areas in which Canada needs to acquire foreign technology, and enhancing ways of acquiring such technology.

The need for better linkages between universities and industry within Canada was often mentioned. Effective cooperation between the academic and industrial sectors was widely viewed as crucial to the development of new wealth in this country.

Increasing Support for University Research

Participants recognized that universities today are in difficulty as a result of increased costs and reduced funding. They warned that cumulative funding reductions could seriously undermine Canada's ability to conduct R&D.

A number of alternatives to government funding were put forward. These ranged from an increase in tuition fees (although some delegates preferred to decrease fees or keep them low) to "spending smarter" on existing programs to get more value for the money, and rearranging priorities at both federal and provincial levels so that more money can be directed to university research.

The federal granting councils were viewed as having played a generally effective role in distributing research funds to the universities. Participants urged the government to reconsider the five-year plans of the councils and to restore inflation protection to their budgets. They expressed deep concern that the new matching funds program might prove unrealistic in as much as private-sector contributions in the later years of the program might not be forthcoming at the levels predicted. They also suggested that the overhead costs of research should be covered by all grants and contracts; universities should not be expected simply to absorb these costs in their operating budgets.

Financing Basic and Strategic Research

There was agreement that governments must accept the prime responsibility for funding research at the universities. Support for research should be based on its merit, rather than on whether it is basic or strategic. Adequate funding would foster excellence, promote critical mass, and encourage long-term commitment to research projects.

Participants agreed that:

- the amount, relevance, and quality of research done at Canadian universities all need to be increased;
- funding must be more selective in order to support first-class people;
- support must be given to promising, well-qualified young faculty members;
- research activities must be maintained to ensure the high quality of university teaching;
- R&D efforts must be coordinated with important industrial priorities;
- the cross-fertilization of disciplines should be actively promoted;
- research should be understood to include social research.

Agreeing on University Financing

It was stressed that the federal and provincial governments must resolve their differences regarding the financing of universities. The future of Established Programs Financing agreements covering federal transfer payments to the provinces for post-secondary education and any improvement in university research funding should be worked out according to overall national objectives. It was strongly suggested that the federal government should not proceed with any changes to Established Programs Financing that would reduce the funding of university research.

Promoting Centres of Excellence

Participants expressed qualified support for the proposition that centres of research excellence should be promoted. They agreed that networks are preferable to the deliberate geographic concentration implied by centres of excellence; however,

they understood that there may be times when geographical concentration is necessary for critical mass. In certain regions it may be more appropriate to develop centres of expertise matched to the needs of local industries.

Although participants endorsed the need for excellence in research, they noted that it cannot be achieved simply by government fiat. Moreover, research excellence should not be considered the exclusive preserve of the universities. It can also flourish in community colleges, government laboratories, and industrial research centres.

Training a Highly Qualified Work Force

Canada's pool of expertise in science and technology is too small to allow training and development to be restricted to post-secondary institutions. It was agreed that all research facilities, whether in government, industry, or elsewhere, should be used to provide high quality training for the work force. This would have private and government laboratories entering into new arrangements with universities so that these laboratories could be used for training. It was further agreed that the labour movement, industries, and educators all have a responsibility to see that effective training programs are available.

Educators must recognize that training is not restricted to graduate programs but starts at school level. Science education must include training not only in how to conduct research, but also in more general matters to prepare students to be managers and decision makers in a society based heavily on science and technology. The social sciences and humanities should not be neglected in the training of science and technology personnel. At the same time, it was recognized that training and education should be more closely linked to the needs of eventual employers.

The Role of Government Science

It was believed that there is not sufficient evidence either to call for changing the research conducted at government laboratories, or for moving it out into other institutions in industry or the academic milieu. However, it was agreed that a review of

the government laboratories would be appropriate and that change might follow.

Participants commented that many government laboratories serve a vital industrial role (as in agriculture), maintain specialized equipment no Canadian industry can afford, or serve specific national needs (for example, in standards definition and in environmental and health protection). They thought that industry should have a more direct say in the management of government laboratories designed to meet industrial needs.

Participants also suggested that the experience of other countries argued for caution in changing government science. They pointed out that countries that have reduced the direct role of government in research now fear that they have gone too far, since the type of research done by industry is often directed only toward short-term goals.

Increasing the Flow of Information to Industry

Discussion of the proposition that a regular research inventory could facilitate information exchange and technology transfer led to the conclusion that general inventories of research are undesirable and are not a good use of government funds. Academics already know what is going on, and there are better ways of increasing the flow of information to industry. These include:

- open-house days for industry at university laboratories;
- greater exchange of personnel between institutions;
- continued reliance upon technology centres;
- wider dissemination of the annual research reports of the federal granting councils;
- more effective communication between researchers across the country.

Support for Megaprojects

Participants agreed that it was appropriate for Canada to undertake large-scale projects in basic science in conjunction with other countries; however, they expressed concern that some projects would demand so much money that they might totally distort the fabric of science in this country.

Involving all Canadians and Adapting to Change

In the workshops on adapting to change, participants paused to reflect upon the essential purpose of scientific and technological development. To some extent their reflections were prompted by the very phrase "adapting to change": how can change be planned and directed to meet the goals of society?

Some participants felt that socioeconomic policies should be decided first and that the application of technology should be directed toward social goals, especially those goals that contribute to human dignity and a decent standard of living. Others emphasized economic goals, holding that the first priority must be to generate wealth by applying technology in industry. Without new wealth creation, everyone will suffer — not just workers, not just managers, but the whole country. There was agreement, however, that the aim of any change in society should be to make a better life for all, and that the human cost of technological change must be kept to a minimum.

Need for Social Policies

Participants agreed that social policies are needed to ensure equal opportunity and the equitable distribution of income, as wealth-creating industries become more productive and less labour-intensive.

There was concern that some of the propositions cast technology in a negative light. Participants pointed out that technology can create jobs as well as eliminate them; it can also make work more interesting. Labour delegates were less enthusiastic about the promise of technology in view of the high levels of unemployment in Canada — up to 50 per cent in some areas. They doubted that the application of technology could create sufficient new employment to offset current job displacements.

Planning for Change

Participants agreed that planning was needed to minimize any harmful social and environmental effects of technological change and to avoid the

remedial intervention that is needed once damage has already been done. They further agreed that technological change should be cooperatively planned and implemented, with all concerned parties involved from the outset.

There was agreement on the need for legislation to protect Canadians from the harmful effects of technological change. But there was disagreement over who should pay for such protective measures and how they should be implemented. In particular, industry representatives objected in principle to legislation that would limit their ability to compete in international markets. Labour, on the other hand, considered legislative protection absolutely essential to preserving not only a basic level of income security but also human dignity.

Easing Job Dislocation

Many participants (not only those from labour) emphasized that technological change affects people, especially in the workplace. They agreed that the burden of change should be eased by paid educational leave and massive retraining, but disagreed as to how that should be paid for.

Labour representatives by and large argued for legislated rights to retraining, whereas others expressed grave doubts about the efficacy of such an approach. Although participants agreed that certain industries undergoing major structural changes may require protective legislation, they cautioned that the hidden costs of contemplated legislation must be fully appraised.

It was suggested that the labour movement, industry, and universities all have a responsibility to promote training programs, and that incentives may offer an alternative to legislation in ensuring that such programs are available.

Importance of General Education

For Canada to cope with social and economic change, it must provide everyone with the best general education possible — an education comprising not only the traditional basics of language and mathematics, but also the new basics of contemporary culture: science and technology, and their impact on society. In particular, science education should be guaranteed at all levels of the

school system, starting with elementary school. Every effort should be made to encourage women to become interested in science and technology and to choose careers in these fields.

Excellence in science education depends primarily on the quality of the teachers. It was agreed that teachers generally have too little exposure to science and technology in the course of their professional development, and that it is important to correct this.

Many participants made reference to the Science Council's science education study, and several noted the slowness with which the provinces have reacted to the recommendations. Several also raised the possibility of developing a truly national educational policy that could overcome the jurisdictional balkanization that exists at present. It was suggested that the time has come for governments to consider a national conference on education.

Studying Technological Change

It was agreed that Canadians, as a society, have a responsibility to study and report on both the costs and benefits of technological change. To this end, existing programs of research should be expanded and interdisciplinary programs should be encouraged. Researchers in the social and behavioural sciences as well as the humanities should be invited to work with natural scientists and engineers in studying the broad social implications of technological change. The impact on the working population should be a specific topic of study.

Participants were sceptical of the need for specialized research institutes. Instead, they suggested working within existing structures and sponsoring the best social scientists to undertake the necessary research.

Increasing Public Awareness

The need to increase public awareness of the nature of science and technology and of their importance to Canada's future was stressed in every workshop. There was general agreement on the importance of a greater degree of scientific literacy and the achievement of a concept of culture in Canada that embraces science and technology.

It was agreed that Canadians should be more aware of their achievements and capabilities in science and technology. Public awareness programs should emphasize Canadian accomplishments in science, as CanLit has done for literature. High-profile projects led by Canadians could help to change public attitudes and encourage young people to believe that scientific achievement is not beyond their grasp. Large national projects, such as the Canadarm, capture the public's imagination and teach Canadians to see themselves not merely as purchasers of foreign technologies, but as innovators as well.

Since science and technology are major aspects of modern culture, Canada should have a broad variety of tools for communicating to the public the interactions between science, technology, and society. These would include:

- paid educational leave to help people understand and participate in technological change;
- more science and technology museums and more travelling exhibitions, coupled with more use of existing museums by the schools;
- a national magazine on science and technology issues, providing balanced views in lay terms;
- increased coverage of science-technology-society interactions by television, radio, and print media;
- encouraging voluntary organizations that work to enhance public awareness of science and technology;
- an annual event such as a Canada Science Week.

Creative ways of financing increased communication activities must be found. Members of the Canadian Manufacturers' Association are already involved in organizing field trips and providing speakers, and the Association des médecins de langue française du Canada has an annual exhibition on technological advances in medicine for the public and for schools. These are examples of the kinds of activities that should be widely undertaken. In addition, cooperative ventures could be developed between industry and the National Museum of Science and Technology.

Efforts should be made to provide all students, especially those in the humanities and the liberal arts, with courses on science and technology and their impact on society. Professionals in science and technology may benefit from such courses as

well. Such measures would increase the overall level of scientific awareness.

Finally, academics were urged to make serious attempts to keep the public aware of their research activities, and scientists were urged to invest more of their budgets in public information.

Developing Entrepreneurial and Managerial Skills

All participants agreed that a clear distinction should be made between entrepreneurship and management. They had difficulty in believing that the entrepreneurial spirit can be imparted by formal training at university level, but agreed that entrepreneurial skills could be developed. Ways must be found to pass on the acquired knowledge of existing entrepreneurs and to motivate young people to go into business for themselves. Cooperative education, work terms in industry, and some form of apprenticeship were suggested as methods of doing this.

Students have a limited understanding of the work world, and their education tends to train them to be employees. The future wealth of the country depends on enterprise and innovation. The challenge is to help young people conceive and realize their own ambitions, and to be open to the possibility of creating their own employment. Student venture capital fund programs were mentioned as one way of providing this help.

There was broad agreement on the usefulness and necessity of existing university-level training programs in managing technology and innovation. It was agreed that it would be useful for institutes of higher education, in association with business, to establish short training programs in this area for people already in the work force.

Giving More Weight to Science and Technology

There was unanimous agreement that governments must publicly recognize that science and technology are crucial not only to economic development but also to social and cultural development. This recognition must be reflected in the political structure so that science and technology are represented at the highest level of cabinet decision making.

It was noted that although many provinces are reasonably well equipped to deal with science and technology at the decision-making level and have already integrated science and technology into economic and industrial policy, the federal government is still not well organized on this front.

Participants were concerned that legislators generally have little feeling for science and technology and, as a result, tend to make policy decisions in a vacuum. They argued that mechanisms should be put in place to keep politicians informed of the importance of science and technology in society. The creation of the House of Commons standing committee on research, science and technology in February 1986 was praised as a valuable step in this direction.

5. The Plenary Session

Reactions from Business, University, and Labour Sectors

After summarizing the results of the workshops, the chairman called on spokespersons from business, university, and labour to give the views of their sectors on matters under discussion at the forum.

Mr Gerry Dyer, manager of research for Du Pont Canada Inc. and chairman of the R&D committee for the Canadian Chemical Producers' Association, was the first to speak. He pointed out that, in the view of industry, the purpose of science and technology should be to improve the international competitiveness of Canadian industries and businesses so that they can continue to fulfill their role of creating wealth.

Mr Dyer said that a necessary step in becoming more competitive is to ensure that the development of products and services, and therefore technology, is driven by the needs of Canada's customers. It is also important to build up the skills of the industrial sector, since industry is expected to carry the results of R&D into the marketplace.

Highly trained people are a prime requisite, and industry sees training them as the most important role of the universities and colleges. Industry also recognizes the importance of university research as a prime source of new scientific knowledge.

To strengthen its innovative ability, industry would generally agree with the use of government procurement programs, the need for long-range and stable policies, and the benefits of making more money available for starting up innovative ventures.

It is always easy to ask for more money for research, Mr Dyer commented. However, those involved in developing science and technology should first make sure that existing R&D funds are put to the most effective use. They must be prepared to reallocate funds within their budgets as circumstances change.

Mr Dyer noted that deep concern had been expressed at the forum about the displacement of jobs resulting from the introduction of technology. He stated his belief that Canadians are committed to the principle of a responsible society and, as a

consequence, the burden of change should not rest unfairly on any particular group. Because it is a caring society, he suggested, Canada may be able to adapt more effectively than some of its competitors to the changing technological world.

Finally, Mr Dyer observed that Canada does not value the development of technology as highly as do some other countries. Yet this country must place more importance on technology if it is to build on its strong science and technology base and improve its competitive position.

The second speaker was Dr Arnold Naimark, president of the University of Manitoba. He did not believe that the sole or even the main purpose of science and technology was to create wealth. There are many purposes for science and technology, he said, not the least of which is to increase people's understanding of themselves and the world in which they live.

From a university perspective, he said, the most important point to emerge from the forum was that improving the nation's basic research capability is crucial for Canada's future and that the best way to achieve this is to increase support for research in the universities.

University research can flourish only if the universities are healthy, Dr Naimark observed. Uncertainty about funding must be resolved by settling the dispute between the two levels of government over fiscal transfer arrangements.

The federal government's recently announced plan for financing the granting councils needs to be modified, he said, so that increases in the base funding itself during the next five years would offset the effects of inflation and even allow for modest growth. In the matching grant component of the plan, disincentives to private-sector support of university-based research should be avoided. Specifically, contributions made directly to universities should be eligible for government matching.

Dr Naimark suggested that the universities could work more closely with industry by carrying out more joint research projects and helping to commercialize new products and services. The universities could also undertake more social research as an aid to managing technological change. Moreover, they could expand their educational role by retraining members of the work

force, offering science courses for the media, and training teachers to be more effective interpreters of technological change.

The third speaker, Ms Nancy Riche, executive vice-president of the Canadian Labour Congress, focused her remarks mainly on the theme of adapting to change and involving all Canadians. Commenting on the fear of technological change, she said that many people are afraid of losing their jobs because of new technology. It is labour's belief that public policy must provide for the individuals who will be affected. Any national policy for science and technology must envision social as well as economic progress, emphasize individual adjustment, and counter regional imbalances.

Ms Riche said that labour feels more research is needed on the social impact of technological change. At present there are wide discrepancies in research findings, with some studies suggesting that as many as a million people may lose their jobs, and others predicting that there will be massive increases in new jobs.

People are the most important element in technological change, she stressed. Science and technology policy must be based on the premise that Canada is a caring society and that the purpose of technology is to serve people. But there can be a truly national policy only if all participants, including workers and consumers, are involved. For this reason, labour agrees on the need to increase public awareness, to include science in the curriculum at all stages of education, and to make science courses at all levels available both to girls and to boys. Labour also believes that, because serious job dislocation is to be expected, the right to retraining should be legislated and full employment should be Canada's priority in responding to technological change.

Comments from Delegates

After the presentation of these viewpoints, Dr Smith invited comments from the floor.

Several of the points raised by delegates related to the concept of science and technology. One delegate strongly urged that the phrase should be "research, science, and technology" in case

policymakers take too narrow a view of the subject. Others recommended more use of the word engineering, to emphasize the intentional shaping of change for society's benefit. A dictionary definition of technology was also quoted: "Technology is the knowledge and means by which society most effectively provides and produces the necessities for its survival."

To support the development of new knowledge means making hard choices, one delegate pointed out. There are always new areas emerging that require resources, and other areas that should be cut. Other delegates commented that higher education has already been seriously hurt by cutbacks in funding. They regretted the further cuts proposed in Bill C-96 and warned of the long-term consequences of discouraging research by graduate students.

A larger role for community colleges in applied research was suggested in comments from the floor. Community colleges should do more to help industry develop new products. Practical involvement in product development would help the colleges to train the technicians Canada needs to make greater use of technology.

One delegate strongly urged universities to increase the science content in their programs and to assign higher priority to teaching the ethics of science and the underlying principles of science and engineering.

Two delegates drew attention to the fact that technology transfer from abroad had not been discussed sufficiently at the forum. One called for national science policy to recognize that attracting foreign investment to Canada is important for the technology it can bring as well as for the new jobs it can create. The other commented that Canada produces about 2 per cent of the world's technology and depends heavily on foreign technology for economic growth. He urged support for international cooperation in technology exchange and in joint projects that Canada could not undertake alone. He also stressed the importance of ensuring access to foreign technologies in an era of growing protectionism.

Freer trade is currently a priority on the Canadian political agenda, delegates noted; however, not everyone agrees that freer trade is appropriate for Canada. The development of

science and technology policy should therefore not be based on the assumption of a freer trade environment, they said.

Delegates felt that fostering the application of science and technology in world-class industries to improve their international competitiveness should not be the sole economic objective of a science and technology policy. Significant contributions to local development and job creation can be made by smaller-scale industries serving import-substitution markets, and a science and technology policy could help by encouraging the application of science and technology in these industries, too.

Small and medium-sized enterprises need more assistance in applying technology, delegates said. They suggested that technology centres across Canada might be able to help by identifying the kinds of problems encountered by SMEs and by recommending ways of overcoming them.

Delegates were unanimous on the need for science and technology to have a more senior status and a more prominent place in the federal decision-making process generally. The area is so crucial to Canada's future that it must have a "champion at the top" to guarantee the emphasis it deserves in the setting of national policies and priorities.

6. Close of Proceedings

Following comments from the floor, the chairman brought the forum to a close by reminding participants that the expected outcome of the meeting had been achieved, namely agreement on the major themes of a national policy on science and technology.

Even where differences were evident, Dr Smith said, they were differences of emphasis. He detected no disagreement at all in the belief that science and technology were essential to our economic progress and must also serve the social goals of a caring society.

In closing the forum, the minister, Mr Oberle, thanked delegates for their participation, noting that their ability to accommodate diversity had made consensus possible on many important issues. Although sceptics had said it would be impossible to achieve consensus with such a large and diverse group, agreement had been reached on enough matters to provide a solid footing on which to build a national science and technology policy.

The minister thanked all those responsible for organizing the forum, and the proceedings then concluded.

Appendix A

Excerpts from the Minister's* Letter of Invitation to Participants at the Forum

You may be aware that a joint initiative of federal and provincial ministers of science and technology will result in the Canadian Forum for the Development of a National Science and Technology Plan being held in Winnipeg at the Fort Garry Hotel on 8-10 June 1986.

This is an ambitious undertaking to mobilize Canada's scientific and technological resources in pursuit of economic renewal and social well-being for the decades ahead. For such a plan to have a national character, industry, academic, and labour leaders must play a strong role in its development and operation.

To reflect this broad base of participation, I have asked Dr Stuart L. Smith, chairman of the Science Council of Canada, to chair the forum, to manage its course, and to produce a summary of the proceedings.

I would like to invite you, on behalf of your organization, to take part in the forum. I also invite you to outline your views in a paper contributing to the development of a national plan . . .

I assure you that the results of the forum will be central in considering federal policy, and as the topic of discussion at a federal-provincial meeting, which I hope will take place in the autumn. I hope you agree with me regarding the importance of the event and that we will be able to benefit from your participation.

* The Honourable Frank Oberle, minister of state for science and technology.

Appendix B

Questions Attached to the Minister's Letter of Invitation*

Developing and Acquiring New Knowledge

1. In your view or that of your organization or sector,
 - a) is Canada getting maximum benefits from money spent on *university research*? If not, what steps should be taken to improve the situation?
 - b) if new money were to become available, should it be used for *university research* and, if so, how should it be spent to assure maximum benefit to the country?
 - c) are you satisfied with the rate of progress toward university-industry cooperation in science and technology? Should it be further encouraged and, if so, how can we foster better linkage between the private sector and universities?
 - d) how can your organization help Canada to develop our intellectual capital so that it can be applied to Canada's needs? so that Canada can acquire new knowledge? in the training of highly-qualified personnel?
2. In your view or that of your organization or sector,
 - a) is Canada getting maximum benefits from money spent on *government laboratories*? If not, what steps should be taken to improve the situation?
 - b) if new money were to become available, should it be used for *government laboratories*? and, if so, how should it be spent to assure maximum benefit to the country?
 - c) are you satisfied with the rate of progress toward government-industry cooperation in science and technology? Should it be further encouraged and, if so, how can we foster better linkage between the private sector and government laboratories?
3. How could Canada realize more benefits from *international* science and technology developments? How could Canada be more involved in the international S&T networks? in contributing Canadian expertise to international development and cooperation? in recruiting scientists of other countries to share their knowledge in Canada? How can my organization or sector play a greater role in this?

* These questions were intended to suggest issues on which organizations invited to the forum could focus the briefs requested by the minister (see Appendix D).

Putting Knowledge to Work and Realizing Opportunities

4. Should Canada target its science and technology resources in a range of strategic areas so as to maximize return? If so, how?
5. What can government do to make sure that Canada's companies are using the *best available* technologies? What can your organization or sector do to help?
6. What can your organization or sector do to improve methods for diffusing new technologies? enhancing technology transfer? making possible development, commercialization, financing, and marketing in all areas of our business sector?
7. By what mechanisms could governments encourage linkages between advanced technology and machinery companies on the one hand, and the existing resource sectors on the other? Why do these linkages seem insufficient at the moment, and what can be done about strengthening them?
8. How could pre-venture capital be rostered and targeted to the high-risk advanced technology industries? What is the provincial role as compared to the federal role?

Adapting to Change

9. What can we do to help Canadians deal with the dramatic sweeping changes in all aspects of life which technological change will confront us with in the next two decades? to develop a new spirit of collaboration instead of confrontation and competition? to ensure that technological change is managed in an intelligent and equitable fashion? to promote greater public awareness of, and participation in, the issues of science and technology?
10. Given market forces, the need for "critical mass," and the tendency of advanced technology businesses to locate in clusters — all of which lead to concentration — what should be done by government and by other sectors to ensure regional balance?
11. What measures need to be taken to enhance the joint collaboration of labour and management in the introduction of new technologies?

Putting a National Science and Technology Strategy to Work

12. In the successful development and implementation of a National Science and Technology Policy, what are the respective roles of the federal government? provincial governments? universities? the private sector? labour? non-governmental organizations? your own organization or sector?
13. What can your organization or sector do to ensure continued coordination and collaboration with all other participants in the effort? Is there a particular mechanism that would make this collaboration more effective? What targets can be set that will guide in the implementation of the policy?
14. Do you have any other suggestions regarding a National Science and Technology Policy and the role to be played by sectors such as your own?

Appendix C

Executive Summary of Background Paper, "Building on our Strengths"*

This background paper for the National Forum provides a general overview of the major characteristics of the Canadian scientific and technological effort. It does so within the framework set last year by federal and provincial Ministers responsible for science and technology to establish a National Science and Technology Policy.

The paper assesses the major international and domestic forces that will help define Canada's thrust in science and technology. Among the international trends are the tendencies toward the internationalization of R&D and the focus by nations on concerted strategies for developing new technologies. On the domestic front, Canada is attempting to meet this challenge, but is faced with certain structural and institutional deficiencies. Among these are the weak private sector R&D infrastructure, and the fragmented science and technology base.

These matters suggest there is an urgent need for Canada to develop a cohesive approach to the new challenges and to define the objectives of a National Science and Technology Policy.

The paper then presents four themes that provide the agenda for discussing the parameters of a National Science and Technology Policy.

The development and acquisition of new knowledge is a theme that revolves largely around the role of universities in basic research and in the training of highly-qualified personnel. There is considerable evidence to suggest that the strength of our university system is weakening due to underfunding, growing obsolescence of the research infrastructure, aging of the research faculty, and threats of a brain drain of key, young scientists and engineers.

The federal laboratories, technology centres, and provincial research organizations represent another critically important but fragmented source for acquiring and developing new knowledge. Canada has strengths in certain key technologies of strategic importance that will need further development and strengthened long-range national plans.

Putting this knowledge to work and realizing opportunities will require a special effort by the private sector: a sector that has certain structural features that make the task a daunting one. Governments have a critical role to play in providing an appropriate climate for investment in science and technology. This includes using procurement mechanisms to greater effect, encouraging foreign investment, promoting small business development, enhancing trade strategies, and optimizing the use of the Economic and Regional Development Agreements.

All of this requires a *national ability to adapt to change* effectively. Public awareness programs need to be enhanced, our young people must be better prepared through a strengthened science education system, and our work force must become better adapted to the effects of technological change. As the paper also points out, management has to increase its ability to understand and introduce new technology within the productive sector.

For each of the above three themes, the paper highlights some of Canada's strengths and opportunities in the area of science and technology. These include developments in the telecommunications and aerospace sectors, as well as the recent initiatives to bolster Canada's space program. New initiatives in science and technology are on the rise, particularly with the increased participation of provincial governments in formulating science and technology policy strategies and/or implementing new measures to strengthen industrial innovation and entrepreneurship.

Putting a national science and technology policy to work implies that:

- clear focal points must be created for a national technological effort and must involve a cooperative venture of all productive sectors of the economy;
- a solid basis for accumulating and transmitting knowledge and know-how must be put in place; and
- there must be an appropriate climate for innovation and entrepreneurship.

* A paper prepared by the Ministry of State for Science and Technology to give participants at the forum an overview of key issues affecting science and technology policy development in Canada. Copies of the complete text are available from the Ministry.

Appendix D

List of Briefs Submitted by Organizations Invited to the Forum

<i>Organization</i>	<i>Title of Brief</i>	<i>Organization</i>	<i>Title of Brief</i>
The Association for the Advancement of Science in Canada	Toward a Cultural Base for a Science and Technology Policy	Canadian Council of Technicians and Technologists	Submission to the National Forum on Science and Technology
Association of Canadian Community Colleges	Response to the Draft Paper "Building on Our Strengths"	Canadian Federation for the Humanities	The Humanities in Canada: Cooperative Strategies for a National Science and Technology Policy
Association of Canadian Universities for Northern Studies	The North in a National Science and Technology Policy	Canadian Federation of Biological Societies, Inc.	The Elaboration of a National Science and Technology Policy: The Participation of Biological and Medical Researchers
Association of Provincial Research Organizations of Canada Inc.	The Development of a National Science and Technology Policy	Canadian Federation of Independent Business	Innovation, Technology Transfer, and Small Business Development
Canadian Advanced Technology Association	Forum on a National Science and Technology Policy	Canadian Labour Congress	Summary of Discussion Paper
Canadian Association of Physicists	Development of a National Science and Technology Policy	The Canadian Manufacturers' Association	Improving our Industrial Competitiveness
Canadian Association of University Research Administrators	Statement to the Canadian Forum on a National Science and Technology Policy	Canadian Research Management Association	The Vital Ingredients of a Science and Technology Policy for Canada
Canadian Association of University Teachers	Executive Summary for CAUT Research and Development Document	The Chemical Institute of Canada	A Science and Technology Policy for Canada
The Canadian Chamber of Commerce	Development of a National Science and Technology Policy	Corporate-Higher Education Forum	Brief Summary Statement
Canadian Chemical Producers' Association	Towards a Science and Technology Policy for Canada	Electrical and Electronic Manufacturers Association of Canada	Summary of a Paper Entitled "Creating the Science Environment"
Canadian Council of Professional Engineers	Canadian Forum on a National Science and Technology Policy	The Fraser Institute	A Brief Reflection on "Building on Our Strengths"
		The Institute of Electrical and Electronics Engineers, Inc.	How to Create Industries of Comparative Advantage

<i>Organization</i>	<i>Title of Brief</i>	<i>Organization</i>	<i>Title of Brief</i>
The Mining Association of Canada	Executive Summary of "Science, Technology and Innovation in the Minerals and Metals Sector"	Association canadienne-française pour l'avancement des sciences	Présentation
National Consortium of Scientific and Educational Societies	The Elaboration of a National Science and Technology Policy: The Participation of the Scientific Community	The Institute for Research on Public Policy	Current Research Programmes in Science and Technology
Pulp and Paper Research Institute of Canada	National Science and Technology Policy Forum	The Professional Institute of the Public Service of Canada	A Review of Problems Affecting R&D in the Public Service
Academy of Science of the Royal Society of Canada	A Brief to the Minister of State for Science and Technology	Government of the Yukon Territory	Statement tabled by the Honourable Tony Penikett, Government Leader, to the National Science and Technology Forum
Social Science Federation of Canada	Towards a Comprehensive Science and Technology Policy	Government of the Yukon Territory	Yukon Science Policy
Agricultural Institute of Canada	Statement to the Ministry of State for Science and Technology		
EPYTEC Prototypes Inc.	University-Based Business Incubators: High Leverage Development Tools for Technology-Based Industry		
Aerospace Industries Association of Canada	Discussion Paper		
National Research Council of Canada	Input to the Federal/Provincial Science Policy Conference		
Women in Science and Engineering	Submission to the Canadian Forum on a National Science and Technology Policy		
Association des communicateurs scientifiques du Québec	Statement for the Canadian Conference on the National Policy of Science and Technology		
Saskatoon Advanced Technology Management Committee	Developing and Acquiring New Knowledge		

Appendix E

List of Debatable Propositions* Considered at the Forum

Theme 1: Developing and Acquiring New Knowledge

Agree or Disagree?

1. Given our industrial structure, the best way to produce the highly qualified human resources we need, and to assure a continuing flow of first-class ideas, is, over and above the augmentation provided by the matching program in the last budget, to increase substantially the level of support for research in Canadian universities.
2. Support to the universities for basic research and for designated research in strategic areas should be increased.
3. Centres of research excellence should be promoted but not to the extent that this would cause severe maldistribution of research support among the provinces.
4. In conjunction with post-secondary institutions, use should be made of all major research centres such as government laboratories and private sector facilities in the training of highly qualified human resources.
5. Provincial governments should increase funding for university research infrastructure and equipment whereupon the federal government should increase funding to cover indirect costs of university research.
6. Canada requires sector- or technology-oriented research centres that are aimed at industrial needs and priorities and that are supported by industry on a shared cost and collaborative basis with universities and governments. Such centres should act as brokers to acquire and diffuse both Canadian and foreign advanced technologies.
7. Where appropriate, the federal and provincial governments should meet on the subject of government laboratories with the intent of moving basic research to universities and possibly other institutions.

8. To facilitate exchange of information and transfer of technology, it would be helpful to have a regular inventory of research and its outputs in Canada.
9. Big ticket projects in basic science in Canada should only be undertaken in conjunction with other countries.

Theme 2: Putting Knowledge to Work and Creating Opportunities

Agree or Disagree?

1. There is insufficient industrial R&D in Canada in comparison with our industrial competitors. Canadian industry should take a longer term view than hitherto and should devote a larger proportion of its own resources to R&D, technology, and innovation, and should do so even at the expense of quarterly and annual earnings.
2. There should be ongoing consultations within industrial sectors to review their strategic positions with particular emphasis on the importance of new technologies and research, especially in the face of the prospects of a freer trade environment.
3. The present system of grants and tax incentives in support of industrial R&D is both adequate and reasonably balanced. Only some fine tuning is required.
4. Federal and provincially funded technology centres should be rationalized based upon extensive review and evaluation. There should be close association with industrial need, and close affiliation with educational facilities.
5. Government should encourage cooperative, pre-competitive R&D among companies in a given sector to be undertaken in partnership with government and funded initially on a 2:1 government/industry basis. Government should appoint an experienced coordinator to help plan and monitor each project. Related industrial research in government could be gradually placed under the control of such new endeavours.
6. Government procurement to promote technological and innovative capability in industry should be greatly increased through the mobilization of civilian and defence technology procurement programs. Such programs plus memoranda of understanding should

* Prepared only for purposes of debate and to help organize the discussion. The list was created by the Science Council of Canada on the basis of briefs submitted by organizations invited to the forum (see Appendix D) and did not necessarily reflect the Council's beliefs or preferences.

favour Canadian-owned companies and only those foreign-controlled firms having genuine world-product mandates.

7. Governments should expand existing successful programs such as those of NRC (Technical Information Service) and university liaison offices that assist small and medium-sized enterprises and large businesses to acquire, apply, and develop technology. Particular attention should be paid to enhancing the capability of provincial research organizations, community colleges, as well as universities, to meet the technology, management, training, and human resource needs of SMEs and large businesses.
8. It should be a major aspect of a federal science policy to act in support of provincial initiatives by placing a greater emphasis on technology development in federal/provincial agreements.
9. Government policies to encourage the formation of more pre-venture and venture capital must be strengthened. As examples: some portion of provincial pension funds should be set aside for this purpose rather than used to finance deficits as is done in some provinces; and venture capital profits should be taxed at capital gains rates.

Theme 3: Involving All Canadians and Adapting to Change

Agree or Disagree?

1. Economic programs based on science and technological advance will meet with legitimate resistance if the costs and benefits are seen to be unfairly distributed. As wealth-creating industries become more productive and less labour-intensive, there will be a need for social policies that ensure equal opportunity and equitable distribution of income.
2. Many citizens see technology as destroying jobs and the environment; therefore technological change should be cooperatively implemented wherever possible by involving all concerned parties from the very beginning and on an on-going basis. This process could be helped by the amendment of (a) labour legislation (on issues such as the definition of technological change; advance notice; consultation; and health and safety standards) and of (b) environmental legislation (on issues such as toxic waste management and pollution control).
3. New technologies will affect the quality and quantity of employment. The burden of change could be eased by paid educational leave and by the creation of a right to be re-trained.
4. As a society, we must develop new techniques to study and report on the costs and benefits of technological change. Increased new funding for social and behavioural scientists and studies of the implications of technological change by specialized research institutes are needed.
5. Training in entrepreneurship and in the management of technology development and innovation is almost completely neglected. University faculties of engineering and management, community colleges and technical institutes must rectify this educational omission. In addition, institutes of higher education, in association with business, should establish short training programs in these areas for people already in the work force.
6. As science and technology decisions affect all Canadians in a fundamental way, it is important that courses on science and technology and their impact on society be a major area of study in Canadian universities.
7. For Canada to cope with social changes, its citizens need the best general education possible — an education comprising not only the traditional basics of language and mathematics, but also the new basics of our contemporary culture: science and technology and their relationship to society. In particular, science education should be guaranteed in every elementary school.
8. Only an informed public can be counted on to maintain social stability in the face of rapid change. As science and technology are major parts of modern culture, Canada should have a broad variety of tools for communicating to the public the interactions between science, technology, and society. This would include more museums or science centres, a national magazine on science issues, as well as the encouragement of existing voluntary organizations.
9. Governments should recognize and state clearly that science and technology are crucial to economic development, and should establish a mechanism whereby science and technology are represented at the highest level of cabinet decision-making.

Appendix F

Forum Agenda

National Science and Technology Policy Forum
Winnipeg, June 8-10, 1986

June 8

1500 — 2100

Registration

1900 — 2100

Reception, hosted by federal, provincial, and territorial ministers.

June 9

0800 — 1000

Registration

0900 — 0915

Opening of forum by Dr Stuart Smith, forum chairman and chairman, Science Council of Canada
Welcoming address by the Honourable Victor Schroeder, minister of industry, trade and technology, Government of Manitoba

0915 — 0945

Opening address by the Honourable Frank Oberle, minister of state for science and technology, Government of Canada

0945 — 1015

The forum divides into six workshops, two on each of three themes:

Theme 1: The Development and Acquisition of
New Knowledge

Theme 2: Putting Knowledge to Work and Creating
Opportunities

Theme 3: Involving All Canadians and Adapting
to Change

1015 — 1200

First round of workshops

1215 — 1345

Luncheon (guest speaker, the Honourable Howard Pawley, premier, Government of Manitoba)

1345 — 1530

Second round of workshops

1530 — 1545

Refreshment break

1545 — 1730

Third round of workshops

1830 — 2100

Reception and dinner (host, the Honourable Frank Oberle; after dinner speaker, Dr J. Fraser Mustard, president, Canadian Institute for Advanced Research)

10 June

0730

Written reports on the outcomes of the workshop sessions made available to participants

0900 — 1030

Plenary session

Presentation of workshop findings by Dr Stuart Smith
Comments by spokespersons from university, industry, and labour

1030 — 1045

Refreshment break

1045 — 1230

Plenary session (continued)

1230 — 1300

Summary statement by Dr Stuart Smith
Closing remarks by the Honourable Frank Oberle

Appendix G

Participants and Observers

(Host)

The Honourable Frank H. Oberle

Minister of State for Science and Technology
Government of Canada

(Chairman)

Stuart L. Smith

Chairman
Science Council of Canada

The Honourable Fernand G. Dubé

Minister of Commerce and Technology
Government of New Brunswick

The Honourable Victor Schroeder

Minister of Industry, Trade and Technology
Government of Manitoba

The Honourable Hal Barrett

Minister of Development and Tourism
Government of Newfoundland

The Honourable Hugh O'Neil

Minister of Industry, Trade and Technology
Government of Ontario

The Honourable Tony Penikett

House Leader
Government of the Yukon Territories

David Berger, M.P.

Standing Committee on Research, Science and Technology
House of Commons

David Daubney, M.P.

Standing Committee on Research, Science and Technology
House of Commons

Joan Dougherty, députée

Secrétaire parlementaire de Monsieur Claude Ryan
Ministère de l'Enseignement supérieur et de la Science
Gouvernement du Québec

Suzanne Duplessis, députée

Comité permanent de la recherche, de la science et
de la technologie
Chambre des communes

Claude Lanthier, député

Secrétaire parlementaire de l'honorable Frank Oberle
Chambre des communes

Guy Ricard, député

Secrétaire parlementaire
Comité permanent de la recherche, de la science et
de la technologie
Chambre des communes

Guy Rivard, député

Secrétaire parlementaire de Monsieur Pierre MacDonald
Ministère du Commerce extérieur et du Développement
technologique
Gouvernement du Québec

Bill Tupper, M.P.

Chairman
Standing Committee on Research, Science and Technology
House of Commons

Mark Abbott

Science and Technology Committee
Canadian Manufacturers' Association
Vice-President
Polysar Limited

W. Peter Adams

Executive Director
Association of Canadian Universities for
Northern Studies
Professor
Department of Geography
Trent University

Robert Alden

Vice-Chairman
The Institute of Electrical and Electronics Engineers, Inc.
Professor
Department of Electrical Engineering
McMaster University

Ed Anderson

University of Manitoba
Canadian Association of University Teachers

Trevor M. Apperley

Director
Corporate and Investor Relations
Develcon Electronics Ltd.

Dan Archer

Technology Division
Ministry of Industry, Trade and Technology
Government of Manitoba

Margaret-Ann Armour

President
WISE — Women in Science and Engineering
Department of Chemistry
University of Alberta

Larry S. Armstrong

Deputy Minister
Department of Commerce and Technology
Government of New Brunswick

Norman L. Arrison

President
Alberta Laser Institute
Member
Science Council of Canada

Donald F. Arseneau

Professor of Chemistry and Director
Bras D'Or Institute
Member
Science Council of Canada

Alan Artibise

President-elect
Social Science Federation of Canada
Director
Institute of Urban Studies
University of Winnipeg

Don Assaff

Vice-President, Research Policy
Corporate-Higher Education Forum
Director of University Liaison
Bell Canada

Alan Astbury

Professor of Physics
University of Victoria

Susan Attenborough

National Representative
Canadian Labour Congress

Morrell P. Bachynski

President
MPB Technologies Inc.
Member
Science Council of Canada

Guy Bertrand

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